A Table-top Hand Loom

THE MODEL ENGINEER

Vol. 87 No. 2148 • THURS., JULY 9, 1942 • 6d.

In this issue

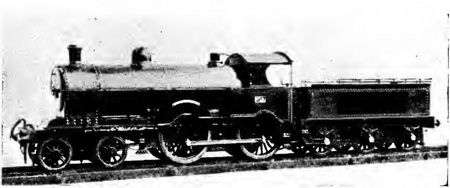


Photo. by] [*C. J. Grose*

A NEW LEASE OF LIFE!

This 5-in. gauge L.N.W.R. "Precursor," built by Carson's about 1911, and altered and amended by various folk since then, has just been reconditioned by "L.B.S.C.," who tells the story on page 35.

THE MODEL ENGINEER

Vol. 87 No. 2148

Percival Marshall & Co., Limited
Cordwallis Works, Maidenhead

July 9th, 1942

Smoke Rings

Workshop Instruction Films

THE United States Office of Education has prepared a range of fifty 16-mm. sound films for the instruction of machinists engaged on war work. This is a very practical extension of the use of films for technical instruction purposes and one which may well be adopted in this country. When the war is over, films of model making methods and activities in general will no doubt be very popular with model engineering societies, and no club equipment will be considered really complete which does not include a projector for regular meeting use. Films of model railway and speed-boat interest have already been shown on many occasions, and some examples of workshop methods in model building may be added to the club film library with advantage.

The Diary of a Model

I HAVE at times seen very interesting life stories of models recorded in album form, with photographs, sketches, and data illustrating the progress of the model from its inception to its completion, and, in the case of a working model, some record of its performance. I think this is a practice which might very well be more widely adopted. Such a record is not only of interest to fellow model makers, but forms material which the actual builder himself may like to browse over, and recall the many moments of pleasure in work well done, and perhaps of difficulties happily overcome. If such a diary is contemplated it is important that it should be put into operation at the time when the model is first planned, and that it should be kept entered up regularly as the work progresses. Memory is sometimes at fault, and it is not always easy to write back accounts of work done, after an appreciable lapse of time. Similarly photographs of work in progress should be taken at the appropriate moment so as to avoid any dismantling of the model at a later date to illustrate a particular detail or assembly. The diary might well include some data as to the time spent on the work, the cost involved, and any special jigs or tools made for the job. It might perhaps be said that details of time and cost do not really matter since hobby model making is done for pleasure, and not to a time schedule or for profit. This is true, but such facts all have a bearing on the value of a model if at any time a sale is contemplated, or if the builder is assailed with questions, as he sometimes is at club meetings or exhibitions, from people who are anticipating the construction of a similar piece of work. The life story of a good model is well worth placing on record, and the day by day, or month by month diary is a practical way of ensuring that the memories of its building are accurately preserved.

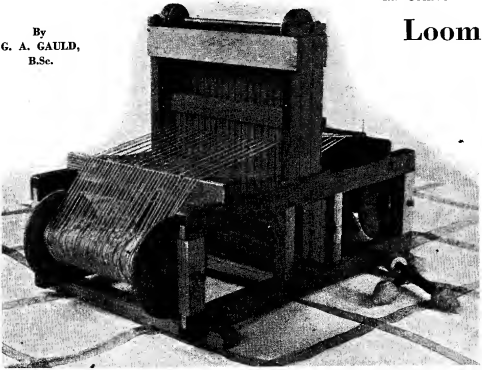
A Holiday Track

FOLLOWING my recent reference to the proposed "Holidays-at-home" running track at Beverley Park, New Malden, I learn that the installation of the track is now an accomplished fact, and that it will be in regular week-end operation for twelve weeks from Saturday, June 27th. It will have gauges for $2\frac{1}{2}$, $3\frac{1}{2}$, and 5 in. locomotives, and the Malden Society will welcome any readers who care to bring an engine along to take part in the passenger service. Insurance is being arranged for, and if transport is required it could no doubt be provided. Any offers of co-operation should be addressed to the Hon. Secretary, Mr. G. F. Tonnstein, of 7, Thetford Road, New Malden. Other holiday attractions on the spot include dancing and a children's playing ground and pool. There will be no arrangements for refreshments, so a picnic basket is desirable.

Percival Marshall

A Home-made Table-Top Hand Loom

By
G. A. GAULD,
B.Sc.



A table-top hand loom for using up odd lenghts of wool.

THE model maker who would turn his skill to good account in wartime may find an interest in the construction of the table-top hand loom described herewith. It is designed to use up the odd lengths of wool left over from the manufacture of wartime jumpers and balaclava helmets.

Common string is used for the warp, the threads being run at 3/16 in. centres, the wool being used only in the weft. Being soft but springy, the wool bunches up, completely covering the string, the final pattern of the cloth having something of the appearance of basket work. Coloured wools may be worked in to give striped or chequerboard designs and several strips of the 6-in. wide cloth may be bound together by a crochet stitch to form such useful articles as the cushion cover shown in one of the accompanying photographs.

A start should be made with the " shedding frames." These carry the " healds " through which the warp is threaded and as they are alternately raised and lowered, so the alternate threads of the warp are split to allow the passage of the shuttle carrying the weft.

The healds are made from short lengths of square section wood strips glued into shallow rebates cut in the top and bottom members of the frames. They are set at ⅜-in. centres with a gap of about 1/16 in. between each strip. After assembly, each heald is drilled through the centre, the holes forming the eyes for the threading of the warp.

Next, the main side frames should be made up, followed by the guides which carry the shedding frames. These can conveniently be made from three strips of " tea chest " three-ply separated by strips of wood a shade wider than the thickness of the side members of the shedding frames. Glued and pinned together, they are half checked into the top and bottom members of the side frames.

By setting up the side frames with the shedding frames in position, the exact length

of the cross members can be determined. These are all morticed in, with the exception of the members which form the feet. These are half checked.

Above the top cross members at each end a further strip is added, in which saw cuts have been made at 3/16 in. centres. The saw cuts serve to guide the threads of the warp and hold them in position as they pass over on to the reels. Tension is maintained by a clamp fixed over the top strip at the rear of the loom, a strip of felt being glued to the underside (see Fig. 2). No clamp is required at the front, but it will be necessary to insert a pin at each side to maintain the true width of the cloth against the pull of the weft as the shuttle is passed to and fro. These are shown in the photograph, but the clamp is not, as it was added later.

The shedding frames are arranged to operate together by means of leather straps which pass over top and bottom pulleys. These are made from ordinary cotton reels cut in halves, and are mounted firmly on 5/16 in. diameter wooden shafts (see Fig. 4). The frames are actuated by levers which project outside the main frame to left and right. Constructional details are shown in Figs. 1 and 5.

A reed, to maintain the correct spacing of the threads, is advisable. It is made up of narrow strips of wood mounted into a frame placed immediately in front of the forward shedding frame, as shown in Fig. 4.

A striker, to knock up each thread of the weft after the passage of the shuttle, is made up in a similar way, as shown in Fig. 3. Mounted on a pivot, it is arranged to spring back out of the way, below the warp, by means of elastic bands.

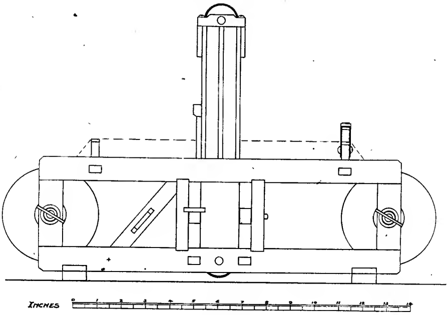


Fig. 1.

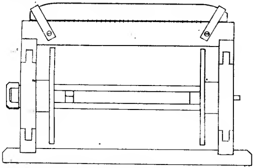


Fig. 2.

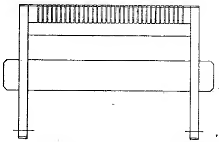


Fig. 3.

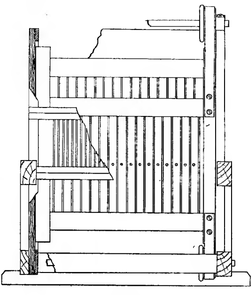


Fig. 4.

The ends of the reels are each made up from a disc cut out of plywood glued to one half of a cotton reel. Two ends are joined by two strips of wood to form the complete reel. The left-hand end turns freely on a simple spindle. A bolt is passed through the right-hand end, through the side frame and secured by a wing-nut. By tightening the wing-nut, the reel may be secured in any desired position, so as to maintain a tension on the cloth as it is wound up from time to time.

A cushion cover made on the table-top hand loom

Several simple shuttles of the form shown in Fig. 6 should be made so that several different colours of wool may be available for building up a pattern. The loom is completed by the application of two coats of varnish.

Provided the operations are carried out in the sequence for which the loom has been designed, the process of weaving is surprisingly rapid after a little experience is gained. To make a start, assuming that the warp has been threaded and secured to the wind-up reel, the free end of the weft is tied to the right-hand outside thread. The left-hand lever should be knocked down, bringing the front shedding frame into the "up" position. The shuttle is then passed through the opened warp from the right hand into the left. The right hand is now free, first to knock up the striker, then to knock down the right-hand lever, splitting the warp in the opposite direction. The shuttle is then passed through from left to right; the striker is knocked up with the *left* hand; the left-hand lever knocked down, ready for the return of the shuttle; and so on.

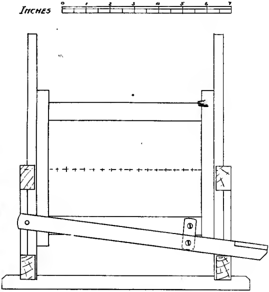


Fig. 5.

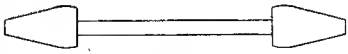
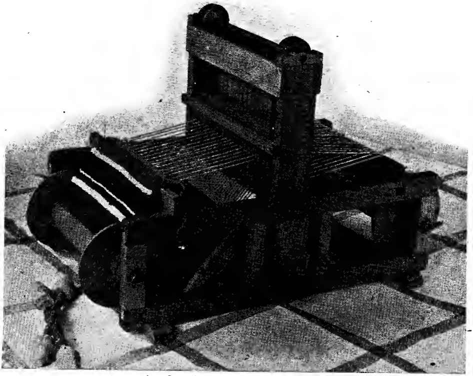


Fig. 6.

When changing over the weft from one colour to another it is not necessary to knot the two ends. The threads are simply overlapped about one and a half inches and given a twist. The minimum amount of tension



Another view of the table-top hand loom.

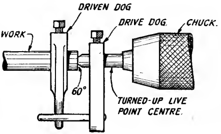
should be given to the weft after it has been drawn through, otherwise the cloth will tend to get narrower and narrower as the weaving proceeds.

After an inch or so of cloth has been woven, it is drawn forward on to the front reel after first slackening off the clamp and wing-nut on the back reel. After the clamp has been tightened, sufficient pull should be given to the front reel before tightening up the wing-nut to maintain a slight tension on the threads of the warp with the shedding frames in the open position.

When the desired length of cloth is completed, the warp is cut through, leaving projecting ends about three inches long. Each adjacent pair of threads is then knotted together to prevent the threads of the weft from working off. The ends may be concealed when the cloth is worked up into its finished form, or may be left as a decorative fringe.

Between Centres with no Drive Plate

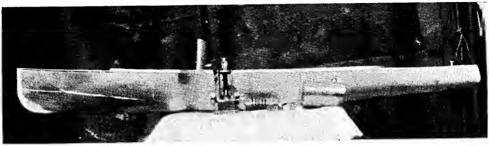
In an emergency arising through one's live centre being scored or blunted, it is possible to mount rod work between "artificial" centres by making up a short point centre and clamping a dog to it, using it as a precision live centre. The dog then drives the work



through another dog. The sketch should make this makeshift tip quite clear.

Incidentally, so long as the rod is not loosened from the chuck, or re-inserted, the centre-point will remain as dead accurate as it was when originally turned up.—F. C.

A 5-ft. Model Speed Boat



THE particulars for this model were taken from Mr. Thomas Dysart's design published in THE MODEL ENGINEER dated 30th July, 1908, under the heading, "Design for a 5-ft. Speed-boat."

The engine, which is built up, has a bore of 1 in. dia. and $\frac{7}{8}$ in. stroke. The cylinder flanges are a tight fit over the cylinder ends and soldered, and the steam face-block with steam and exhaust ports cut out, then fitted to cylinder and soldered. The steam ports are 3/32 in. wide and 9/16 in. long, the valve travel being $\frac{1}{4}$ in. These parts are made of brass, also piston head, cylinder covers, and steam chest, which was cut from the solid.

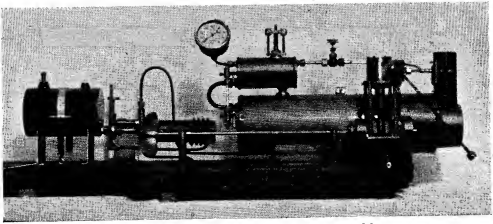
The crankshaft is built up in the usual way, and has two flywheels $1\frac{3}{4}$ in. dia. by $\frac{1}{2}$ in. and $2\frac{1}{8}$ in. dia. by $\frac{1}{2}$ in. The total height of engine is $5\frac{7}{8}$ in.

The boiler is a 4-in. dia. brass solid-drawn tube 13 in. long, 1/16 in. thick, with a copper furnace tube $2\frac{3}{4}$ in. dia., 18-gauge, having 45 $\frac{3}{8}$-in. dia. 20-gauge copper tubes expanded and soft-soldered. The boiler ends are copper, 3/32 in. thick and flanged, riveted by 35 copper rivets, 3/32 in. dia. each end. The boiler differs a little from the design, as my furnace-tube is $2\frac{3}{4}$ in. dia. instead of 3 in. dia. and is expanded and beaded in the boiler ends, for which I made tools. The steam drum is copper with phosphor-bronze ends $1\frac{3}{4}$ in. dia. by 4 in. long, and is secured to the boiler front by a $\frac{1}{4}$-in. dia. copper pipe, having $\frac{1}{4}$-in. gas cone connections. The other connection to the boiler shell is a $\frac{1}{4}$-in. gas hexagon nipple screwed into brass bosses on boiler and steam drum.

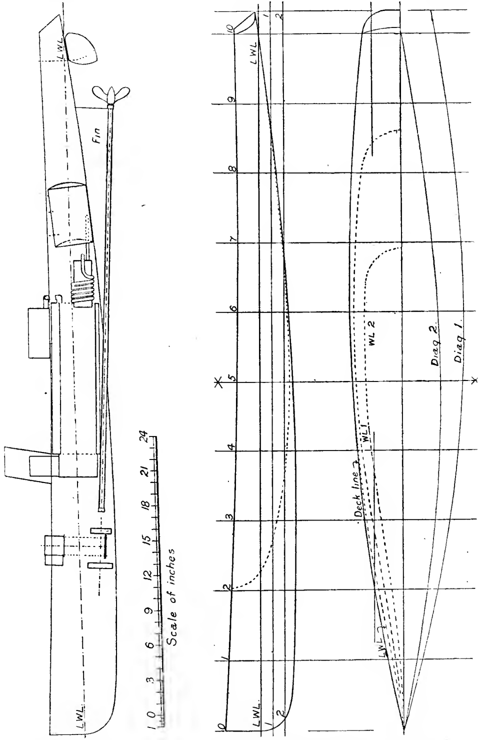
The safety-valve is made up from another $\frac{1}{4}$-in. gas hexagon nipple screwed into a boss on the steam drum. These bosses are soldered to the boiler and steam drum, and the $\frac{1}{4}$-in. gas tap put through both; so, besides being soldered, the nipple screws into both.

The check-valve is made from $\frac{1}{8}$-in. gas fittings and screwed, and soldered in the side of the boiler. The valve is a mushroom type. The smoke-box is fastened to the boiler by four $\frac{1}{8}$-in. dia. studs and nuts, and is made of brass with copper chimney. I gave the boiler a water test to 180 lb. per sq. in., and had quite a number of leaks, which I

(*Continued on page* 42).



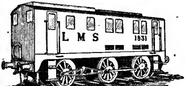
The power plant of Mr. Gardiner's 5-ft. model speed-boat.



The general profile, sheer plan and half breadth plan of the 5-ft. model speed-boat design.
(Reproduced from the "M.E," July 30, 1908.)

*Construction of Transmission Gear

By EDGAR T. WESTBURY



THE shifting fork slide frame (Fig. 122) is a fairly simple component, which may be made from the solid or built up in any convenient material. The easiest way to build it up would be to take a piece of $\frac{1}{2}$ in. by 5/16 in. rectangular bar just over 2 in. long, centre the ends and turn them down to form spigots about 3/16 in. diameter. Side flanges $\frac{1}{8}$ in. thick are then riveted and sweated over the projecting spigots—brazing would of course be better

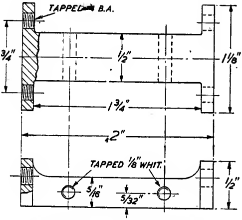


Fig. 122. Shifting fork slide frame.

still, but should hardly be necessary. The end faces should be finished dead flat and parallel with each other, and the overall length adjusted so that the component will slide freely between the side plates of the transmission frame. It is also essential that the top and bottom faces of the centre portion should be parallel in both planes. Drilling of the holes may be deferred until other parts of the shifting gear are completed.

Shifting Fork Plates. (Fig. 123)

These are cut from $\frac{1}{8}$-in. bright mild-steel plate to the shape and dimensions given. They may be clamped together for cutting out, shaping and drilling, in order to ensure that they coincide in essential features. The jaws which fit over the spigots of the friction disc should have plenty of running clearance so that they cannot bind in a horizontal plane, but when the plates are attached to the frame, hardly any vertical play should be perceptible, though there should be no stiffness this way either. The running clearance here may be adjusted by means of paper or metal shims between the plates and their seating on the slide frame, if it is found necessary. After final fitting, the plates may with advantage be case-hardened and polished in the region of the jaws.

Bell Crank Levers. (Fig. 124)

Two of these are required, identical in outline and differing only in the bosses, which are attached to opposite sides, so as to project on the outside of the lever in both cases—in other words, they are right- and left-handed. The levers may be made from $\frac{1}{8}$-in. mild-steel sheet, and the bosses from $\frac{1}{2}$-in. dia. round mild-steel bar, securely and permanently attached after the former

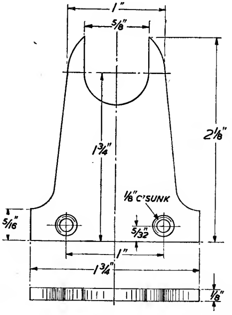


Fig. 123. Shifting fork plates.

* *Continued from page* 623, *Vol.* 86, "*M.E.*," *June* 25, 1942.

have been cut to shape. It will be convenient to mark out the shape of one of the levers and drill $\frac{1}{8}$-in. holes at the boss centre and the extremities of the two main arms. The holes in the second lever are then jigged from these, and the two pieces clamped together by temporary screws for cutting out. Practically all the cutting can be done with a hacksaw, if $\frac{1}{4}$-in. holes are first drilled to form the radius in the angle of the main arms, and that of the subsidiary arm on the underside. File the edges neatly to shape, taking special care to round off the ends of the arms nicely, and finish off by draw-filing with a smooth file.

The two levers may now be taken apart and the burrs removed from the edges, the hole in the long arm then being opened out and reamered 3/16 in. dia., and that for the boss opened out to $\frac{3}{8}$-in. dia.

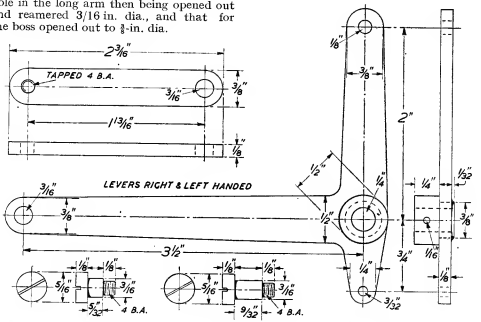


Fig. 124. Bell crank levers, links and pivots (2 off each).

When turning the bosses, the centre hole and the spigot should be concentric, but it is not essential to turn the outside of the boss at all, if the material used is bright mild steel and it runs reasonably truly. Note that the spigot projects 1/32 in. beyond the inside of the lever—in other words, it is made 5/32 in. long—and it should be a good fit in the eye of the lever. The method of attaching the boss to the lever which will be found most reliable is by silver-soldering, but a fairly satisfactory result may be obtained by careful riveting, if this method is preferred. In the latter case, it is advisable to drill the centre hole slightly undersize, and countersink it a little on the spigot end, so that it may be expanded into the eye of the lever with a large centre-punch or similar tool, before peaning over the edge of the spigot. For these operations the boss should be supported truly on a flat block, preferably faced with soft metal to avoid damage to the outer face. It will, of course, be necessary to allow a slight extra length of spigot to make up for that lost in riveting. Incidentally, it should not be necessary to expand the spigot so effectively as to split the eye of the lever, but if this risk is anticipated, a little extra metal may be left on the straight side of the latter to thicken up the weak spot. Finally, the hole in the boss is reamered to fit closely on a $\frac{1}{4}$-in. shaft.

Control Links and Pivots

These are also shown in Fig. 124; the links consist simply of lengths of 5/16 in. × $\frac{1}{8}$ in. mild-steel strip, drilled exactly alike for the pivot pins, and nicely rounded at each end. The larger holes should be finished by reamering, so as to work freely, but without shake, on the pins. Our old friend Mr. George Gentry has recently given us one of his very sound practical homilies on the fitting of pivot pins, which all good model engineers should take well and truly to heart; and although it is hardly likely that the pivots in this particular case will get anything like as much work to do as those in the valve and crosshead motions of a steam engine, proper care in fitting

them will undoubtedly be amply repaid.

The pivot pins may be turned from 5/16-in. mild steel, the threads being cut with the aid of a tailstock die-holder to ensure axial truth ; it will be advisable to turn a little extra length at the end to allow a good "lead" for cutting the thread, and then face it off afterwards. Care should be taken to make the plain part of the pins an exact fit for the holes in the links and levers, also dead parallel and highly finished. It is an advantage, though not a necessity, to case-harden all pivot pins, but if this is done, the threads should be left soft, and the best way to ensure this is to screw some old steel nuts on them to avoid contact with the case-hardening compound.

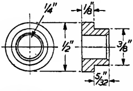


Fig. 125. Control shaft bushes (2 off).

The short pivot pins pass through the ends of the bell-crank levers and are screwed into the holes at the top end of the links, a plain washer being interposed between the two to maintain a clearance and prevent rubbing. (Standard washers in this size are generally made of about 20-gauge material, which will be just about right to take up the play; but if thicker or thinner washers are used, the length of the pivots may be adjusted accordingly.) At the lower extremities of the links, the longer pivot pins pass through the vertical slots in the frame (with washers between links and frame plates) and screw into the lower tapped holes in the shifting fork slide.

Two other pins—not strictly pivot pins—are also required to screw into the upper holes in the shifting fork slide and guide it so as to run smoothly up and down without tilting or binding. These are not shown in the detail drawings, but can be made quite simply by turning the heads of 4 B.A. steel screws to 3/16 in. dia. It is important that they should be chucked truly for this operation, the simplest way being to drill and tap a piece of material held in the chuck and fit them thereto.

It will be advisable to mark off the positions of the tapped holes in the shifting fork slide by assembling the gear temporarily, and noting the extreme limits of travel in either direction, so that the full length of the frame slot is effective for control motion.

Control Shaft Bushes (Fig. 125)

The shaft to which the bell-crank levers are attached works in two brass or gunmetal bushes, which are turned to the dimensions shown and riveted into the frame plates on either side. As in the case of the lever bosses, the spigot should be concentric with the centre hole, which should be left undersize for reamering to size after the frame plates are assembled.

By running a reamer through both bushes after the frame has been assembled, their perfect alignment will be assured. The shaft is simply a length of ½-in. mild-steel rod on which the two bell-crank levers are mounted so that they line up exactly with each other on the outside of the frame, and are then securely fixed in position, preferably by taper pins. It should be noted that power may be applied to operate to control through either of the levers, and their attachment to the shaft must be secure enough to ensure that both move in unison, so that the shifting fork slide is moved squarely up or down without any tendency to tilt.

Withdrawal Shaft Bush (Fig. 126)

This bush is fitted to the ½-in. hole in the offside frame plate, on the centre line of the horizontal shaft, so as to project into the groove in the face of the shaft housing. The flange of the bush is attached by two No. 6 B.A. countersunk screws, which will call for two extra tapped holes in the offside frame plate beyond those specified in the detail drawing. In machining the bush, which may be made of brass or gunmetal, the important points are concentricity of the outer surface with the bore and squareness of the flange, all of which are assured if these are turned and bored at one setting, and with reasonable care; it may be held over the edges of the flange, in the four-jaw chuck. The bush should fit the hole in the frame plate fairly tightly, so that the screws are relieved of some of the wrenching strains which are encountered in working. For facing the outside of the flange the spigot of the bush may be gripped in the self-centring chuck, with a shim of soft metal wrapped round it to avoid marking by the jaws.

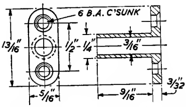


Fig. 126. Withdrawal shaft bush (1 off).

Drill and countersink the screw holes, then insert the bush in position in the frame plate, and use it as a jig to spot the tapping holes in the latter.

(To be continued)

Rejuvenating a "Precursor"

By "L.B.S.C."

PEOPLE usually manage to go from the sublime to the ridiculous (or vice versa) in this benighted world, and your humble servant is no exception to the general rule. After fooling around with the tiny "O" gauge something-like-a-L.M.S. "Princess Eva," I reckoned an antidote was called for, so I set to work and eliminated a few spots of bother in a 5-in. gauge locomotive, to wit, a genuine old Carson "Precursor." The engine had been standing on the floor in my workshop for many moons, getting in my way and accumulating dust, lathe turnings, dead flies, and other impedimenta, and an enterprising spider with mechanical leanings had made a home in the corner of the cab; so apparently it was high time something was done about it. She belongs to a friend whom I have mentioned before in these notes, Mr. R. C. Hammett, of Bexleyheath, and was purchased from a dealer in "used" locomotives. Unfortunately, Mr. Hammett did not see the engine under steam doing the job, as I always stress should be done when purchasing a used engine; consequently he soon found that the engine wasn't all it was supposed to be. After I rebuilt his $2\frac{1}{2}$-in. gauge built-by-the-yard Pacific "Longbody," he brought the "Precursor" along to me, and left it "in hopes" as you might say. Now Carson's engines were always jolly good when they left their works, and as a thing which has been O.K. once can usually be made the same or better, I never "shy" at rebuilding a Carson engine, so long as circumstances permit.

"Patent" Cylinder Cocks

Thus it came to pass that one fine morning after the departure of "Princess Eva," my lass fra' Glasgow helped me lift the big handful on to the "erecting-shop" bench over the heating boiler. As the spider couldn't produce a footplate pass, or even show an identity card, I concluded it must be a "fifth columnist" and "bumped it off," then gave the engine a good clean down and proceeded to investigate. The first thing I found was that somebody else had been having a fine game with it between the time it left Carson's and the time it arrived here; still, considering that it first saw a track somewhere about 1911, that couldn't be wondered at. The cylinders and motion were in fairly good condition, but "Mr. Somebody" had fitted a most weird and wonderful arrangement of cylinder drain cocks. Four pipes led from the four holes at the ends of the cylinder bores to four cocks mounted vertically in a bit of hexagon brass rod screwed across the frames just behind the buffer beam. Between the row of cocks and the cylinder covers, a cross shaft was mounted, and this carried four arms, each of which was connected to a cock handle by a short link. At the end, another arm was mounted, and connected to a lever in the cab, so that all four cocks operated together. Steam and water from the cocks blew straight down between the leading bogie wheels in front of the axle, making a very effectual apparatus for laying the dust in the ballast, and doing a bit of weed-killing

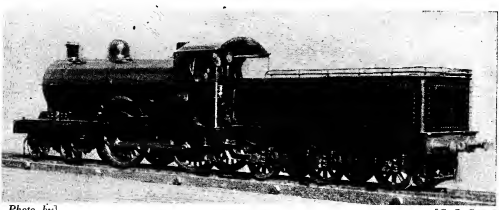


Photo. by] [*C. J. Grose*

Mr. R. C. Hammett's 5-in. gauge "Precursor."

and insect-slaughtering. However, it worked all right, and I was so amused with it that I left it on.

" A Few Little Discrepancies "

The boiler itself was a good strong job, but when I examined it, it reminded me of a Welshman's garden, being full of leaks. It was a rivet-and-solder job ; and as the pump would not pump, and the injector was a " sometimer," and there was no emergency hand pump in the tender, you can guess what had happened. It had run dry, and there were tears of solder all around the foundation ring, backhead joints, and smokebox tubeplate. The firebox was very deep, and stood well over halfway up the barrel ; there were three cross water tubes close to the crown, and twenty-one ½-in. tubes going to the smokebox. The latter contained one of those silly little gridiron gadgets which are supposed to be " superheaters," but are really condensers. There was a ring blower close under the chimney liner, with four jets to it like a Lemaitre blastpipe ; but a fat lot of good it must have been for blowing purposes, as it was supplied with steam by an outside pipe running the full length of the boiler. Mr. Hammett said it made a good fountain.

The footplate was the most awful conglomeration I ever saw in my life. The Carson " window " water gauge had been covered with a plate, and a huge great three-cock gauge, like those illustrated in the antediluvian " model " catalogues, sprawled transversely right across the backhead. A big square chunk of brass was screwed into the wrapper above the regulator, and two wheel valves, nicely matching the gauge both in size and vintage, depended at an angle from it on either side. One supplied steam to the external condensation pipe leading to the alleged blower in the smokebox, and the other supplied steam to the injector. One massive square-bodied clack box, with cock attached, was screwed into the backhead and took the injector delivery —when there was any, that is—and a similar abortion was attached to an angle fitting screwed to the side of the firebox wrapper, because there was no room for it on the backhead. This was connected to the pump delivery. The pump itself was on the footplate, arranged vertically, and worked by an eccentric on the trailing axle directly below it. It had external clacks, a relief pet-cock, and pipework which would have made any self-respecting plumber feel inclined to commit suicide. The pressure-gauge siphon was attached to a clumsy great oblong flange fixed by two ⅛-in. screws, and a similar but larger pad carried another cock with a pipe leading to a whistle below the footplate. A large square " flap " firehole door with side wings was provided, but that was a Carson idea; I saw a similar one on an engine on their stand at one of the Model Engineer exhibitions over 30 years ago. It was the only type of flap I ever saw which could not get jammed, as it had no hinge and worked on a spindle.

The only neat things on the footplate were the regulator handle, though that had an outsize quadrant, and the reversing lever, which by the good rights should have been a wheel and screw. The regulator itself was a Stroudley type, located in the dome. The safety valve was a real caricature, and how on earth the pressure was properly relieved is more than I can fathom. To begin with, the hole was only 5/32 in. diameter (for an " inch-scale " boiler ! !) and contained a three-wing mitre valve. The lever passed across the top of it, and was pivoted to a lug just behind it, a spring being attached to the front to hold it down, spring-balance fashion, the whole being enclosed in a regulation Ramsbottom casing. Anyway, I needn't dwell on all the undesirable features found. The tender was a good sound job, with a brass tank, working leaf springs, and a good working hand brake.

Overhauling " the Works "

A test under air pressure disclosed both valves and both pistons blowing, so down came the lot. The pistons were packed with what looked like chewed string. There were three grooves in each, and after I cleaned out the cylinder bores and refaced the ports, a ring of square braided graphited-yarn packing was fitted into each groove, and the cover joints remade. Valves were faced truly, dimensions being altered to suit my pet settings, and the valve gear repinned where needed. The Joy slide shaft and blocks were in excellent condition and did not need any titivating at all. The original Carson lubrication was by means of a displacement lubricator at each side of the steam chest, and " Mr. Somebody " had added a small tank in the cab containing a commercial feed pump to which a handle had been added. This delivered oil through about a mile of ⅛-in. pipe to an angle fitting on the top of the steam chest. I left the displacement lubricators on, to act as " dope cups " like the little gadgets on the front of the Stroudley smokeboxes ; but the hand-operated " some-timer " in the cab was consigned to limbo. A mechanical lubricator, with an oscillating-cylinder pump, and as large a tank as I could get in the space, was fitted between the connecting-rods behind the motion plate, being supported by a box-shaped frame bolted to the plate. The ratchet gear of this was driven by an

eccentric located between the crank webs, and a $\frac{3}{8}$-in. filling pipe, perfectly straight, was silver-soldered into the lid, and terminated just in front of the leading splasher at running-board level, so it is quite easy to poke the spout of a feeder down the pipe and fill the lubricator at any old time. The delivery from the lubricator goes into the steam line just below the union on the steam chest, so that the steam picks up the oil on its way in, and sprays it.

New Feed Pump

The vertical pump, with all its conglomeration of pipes and clacks, was scrapped. I found there was just sufficient room to get in a horizontal pump, $\frac{1}{2}$ in. bore and $\frac{1}{2}$ in. stroke, between the trailing axle and the drag beam, if I made it like a gas engine with a trunk piston; so I did, and it works fine. The barrel was turned from $\frac{3}{4}$ in. cast gunmetal and counterbored $\frac{5}{8}$ in. for a gland; a square flange $\frac{1}{8}$ in. thick was silver-soldered to one end, and the usual valve box on the other. The gland was made from $\frac{5}{8}$-in. round rod with a similar square flange, and it is attached by a stud and locknuts at each corner, looking very "hydraulic." The original eccentric and strap was utilised, a new rod being fitted which passes inside the hollow piston and works on a gudgeon-pin at the back end. As the eccentric strap only clears the gland by the proverbial "millionth part of an inch" on back dead centre, it is obvious that the usual type of pump would have been too long for the space available. The bypass valve is screwed straight into the top of the valve box and the handle projects up through the footplate, whilst the feed pipe is screwed into the bottom, so that all long pipes are eliminated, the delivery going direct to a clack on the backhead directly above. The hand pump feed is teed into the same delivery pipe.

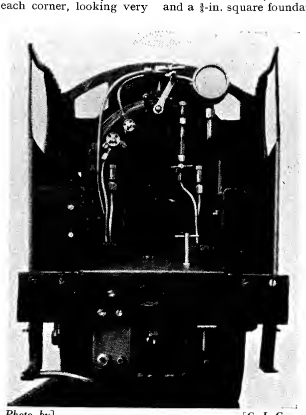


Photo. by] [*C. J. Grose*

The footplate after "Curly" had finished with it.

How the Leaks were Stopped

The boiler was completely stripped; all the fittings came off the backhead except the regulator handle, and the gridiron condenser was thrown away, along with the "patent" blower and the "unsafety" valve. The first job was to stop up all the "Welsh vegetables," and here my Alda blowpipe proved a real friend. It sounds like using a steam hammer to squash a beetle, mending leaks in a soldered-up boiler with an oxy-acetylene apparatus; but, believe me, it is the berries. I found out the leaky places by air pressure, marked them, well cleaned them, and applied Baker's fluid; then soldered up the defective places with a copper bit in the usual way, but—this is the rub—keeping the copper at the melting point of the plumber's solder by playing on the spot with the oxy-acet. flame. As we all know, copper is a wonderfully good conductor of heat, and with 3/32-in. plates and a $\frac{3}{8}$-in. square foundation ring, it would never have been possible to bring the job up to soldering heat by use of the copper bit alone, whilst the diffused flame of a blowlamp, or an ordinary air-gas blowpipe would have meant heating the whole boiler to do the job. But the intense heat of the little oxy-acet. flame popped more "therms" into the spot being operated upon than the copper could carry away by conduction; hence the solder flowed as beautifully as if the job were thin tin-plate, and the boiler never got hot at all, merely comfortably warm. After the operation, I got 100 lb.

of steam on it, with a blowlamp poked through the firehole door, and there were no signs of teardrops.

New Multiple Element Superheater

How on earth anybody could ever expect a little "gridiron" composed of six 2-in. lengths of ¼-in. copper tube with a connecting piece at each end, to act as a *superheater*, on a 5-in. gauge locomotive at that, leaves your humble servant guessing. Even if the temperature inside the smokebox equalled the ditto in the firebox, the gadget would hardly dry "raindrops" out of the steam. Anyway, I took it off, also its unions, and made a new superheater altogether. As there were no big tubes, I utilised the whole of the top row of ½-in. tubes, five in all, to house the elements. Each one is 12 in. long, usual spearhead pattern, made of copper tube barely 3/16 in. diameter and about 22 gauge. The spearheads come to within ⅜ in. of the firebox, and are Sifbronzed. The headers are made from ⅜-in. copper tube, each about 4 in. long, and the lower one, the "hot" member, carries a swan-neck of 5/16-in. copper tube, with ¼-in. union, for connection to the steam chest fitting. The upper one presented a little bit of a problem, as these engines have short smokeboxes, and the boiler barrel entered the smokebox for ½ in. or so, leaving very little space between the smokebox tubeplate and the huge bell-shaped chimney liner. I made a flange about 1 in. diameter and screwed it on to the end of the steam pipe, and into the tubeplate, by the usual "internal-external threads" wheeze, then made a plain flat one ⅜ in. thick to match it, with a four-screw attachment. In the bottom of this a half-round groove was milled, so that the top header bedded into it. Holes were drilled to make communication between the header and the fitting, for steam to pass, and the whole bag of tricks Sifbronzed. When erected, the combined flange and top header just went in between the liner and the tubeplate.

The blastpipe was shortened, and a new cap made with a self-contained ring blower, consisting of a channel-shaped ring silver-soldered to the cap, having three No. 70 holes in it, and a ¼ in. by 40 union fitting for the pipe connection. That dispensed with the "fountain," and finished the front end.

The boiler backhead was set out just as I arrange a 2½-in. gauge engine of similar type, the appearance bearing a good resemblance to the full-sized engine, the fittings being small and neat. A whistle turret of the usual pattern, but standing ⅜ in. above the backhead, was the first item; the two unions connect with pressure gauge and blower valve as usual. The latter is exactly the same size as I usually specify for a 2½-in. gauge job, the pipe going right through the boiler, hollow stay fashion, to a union nipple at the smokebox tubeplate, a short pipe with union nuts at each end connecting that to the blower ring. Directly under the blower valve is a similar one slightly larger, the internal pipe going up into the dome, the outlet being connected to the injector under the footplate. A clack with 7/32 in. ball valve was fixed at each side of the backhead just above the firehole, same as big sister, the right taking the pump feed and the left the injector. A vertical water gauge with 3/16-in. glass was installed to the right of the regulator; and all the connecting pipes and the gauge blowdown were arranged to look as neat as possible. A new direct-acting spring safety valve completed the outfit, and the whole engine was then re-erected.

The tender tank was cleaned out, an emergency hand pump 9/16 in. bore by 1¼ in. stroke installed, and the usual connections for injector, pump feed and bypass fitted, the end of the bypass pipe being arranged under a special little circular lid near the front end on the fireman's side.

On the Road——

The first thing the old cat did was to attempt to bolt. The steam pressure on the end of the regulator rod forced it endwise through the gland and pulled the regulator valve off the port face. As there was no collar on the rod inside the boiler, I put an extra plate on the outside of the sector in which the handle works, which effectually stopped any repetition of that antic, also made "assurance doubly sure" by putting a much stronger spring on the valve itself. The injector, a later addition, of a much boosted make, also dribbled and was a job to start, so I altered that to my own ideas, and it is now perfectly O.K. On the second trial, everything in the garden was lovely. Ably assisted by a friend whom I call "Bro. Teardrop," who is building a 5-in. gauge 0-6-0 tank engine, we had the "Precursor" in steam for 1½ hours, and gave the "Polar Elevated" (the new wide gauge road) a good ironing out. During the test, the local Transport Officer and one of the staff came in, and the engine transported the lot of us on two cars, with the lever one off middle, the "gas-engine" feed pump doing its duty nobly, and the beats when starting being exactly like big sister going out of Euston with the "two-hour Birmingham." In one thing, however, "Precursoretta" does *not* emulate her big sisters; she is just as light on coal and water, as they were heavy! This is due, first to the superheater which is very efficient, and secondly to the valve setting which makes the most use of the steam, and so effects economy.

*ORGANISING the Amateur Workshop

By IAN BRADLEY

WHEN contemplating the setting up of a self-contained machine shop such as was illustrated on page 5 of last week's issue, it should be remembered that the complete outfit is liable to be pretty heavy.

Therefore, if it is to be used in an upstairs room, it is wise to see that the floor joists are adequate to support the load.

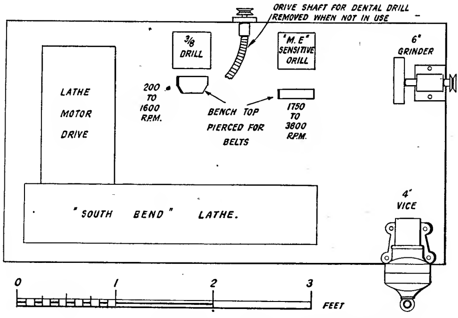
The whole object of such an installation would be defeated if the floor were to give way and precipitate the entire workshop into the room below.

As an example of what may be done with independent motor drives I am reproducing sketches below and on the next page of an arrangement made by Dr. Hallows, of Marlborough. One great advantage of this layout is the ease with which the motors may be removed for inspection and maintenance, and may also be changed over from one tool to another if necessary. The placing of the motors *under* the bench both protects them from injury and economises in space.

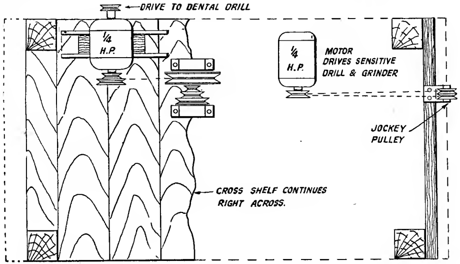
* *Continued from page* 5, " *M.E.*," *July* 2, 1942.

Storage of Lathe Accessories

We come now to the storage of lathe accessories, chucks, change-wheels, etc., etc. The best way to do this is to arrange them in a good strong cupboard, glass-fronted for preference, and stow the accessories by systematic grouping. Chucks and fixtures should be spaced out on thick celluloid sheets, as this acts as a preventative from rust staining should there be any dampness present. From time to time faceplate clamping devices of one sort or another and various hold-fasts will have been made. It is as well to keep these together in a box (an old cigar box serves well), so that they are always ready to hand. With regard to drill chucks: my own preference is to keep these with the twist drills, and I will deal with this matter later.



Plan view of bench top.



View to show location of countershafts and motors directly under top of bench.

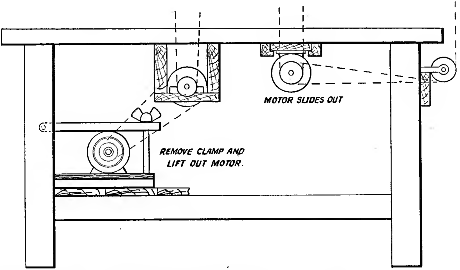
As to change-wheels, I think these are best stored in the "lathe cupboard." Hang them individually if you wish, but as one does not very often change them about, it seems just as well if these are stored in an orderly pile.

Now with regard to chuck keys: my own preference is to have them handy to the tool with which the chuck is to be used. To this end they are hung on cup hooks, from which they can be quickly removed when required.

Whilst on the subject of the storage of lathe gear, the question of slide-rest tools arises. I have tried dealing with these all ways and have come to the conclusion that by far the best way is to group them horizontally on shelves, as this enables one to identify with ease the particular tool required.

Storage of Twist Drills, Drill Chucks, etc.

As to twist drills: as time goes on a number of sets will find their way into the shop. In order to cover all requirements, three sets are really necessary: 1 set—0-½ in. by 1/64ths; 1 set number size drills, 0-60; 1 set letter drills, A-Z.

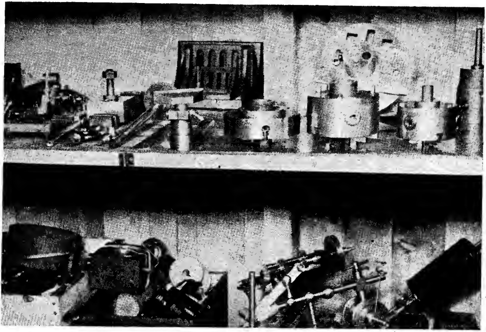


Side elevation of the self-contained machine bench.

In addition, odd drills for special purposes will in all probability be acquired and there may be some drills with Morse taper shanks.

These latter are conveniently stored on racks which may be screwed to the wall where space is available. These same racks may be used to store any drill chucks which have Morse taper pegs. This leaves the chucks " at the ready " and saves bruising the taper peg, which invariably occurs if chucks are thrown together in a box.

This, for the moment, disposes of the machine tool aspect of the situation.



Inside the " workshop cupboard."

Benches

We come now to the matter of the work bench ; this (like the machine tools) should be placed so that, in so far as is practicable, light falls on the work, from in front and from above. In other words, if the bench is placed opposite to a window (in the case of most amateur shops it will be) it should have top light as well. I know that this arrangement is not always possible, but it should be aimed at. Two benches are an advantage, one for filing, sawing, etc., the other for laying out partly-finished work, final assembly, marking-off and the like, where cleanliness and freedom from dust and swarf is imperative.

Whatever the erecting bench may be, the filing bench *must* be strong and rigid, and no pains must be spared to see that it is so. The top (at any rate the front portion of it on which the vice is fixed) should be constructed from 9 in. × 2 in. deals, the frame should be made from 4 in. × 2 in. and the legs from not less than 3 in. square material. A light bench is quite useless for filing purposes, as it encourages the files to " scream " and prevents accurate filing and good finish. The vice should be mounted *over* one of the legs, which must, of course, be firmly fixed to the floor. The bench as a whole should be made fast to the building itself.

Some people fix a corticene top to their benches ; this is a sound idea, as it shows up dirt, is easy to sweep down and so promotes cleanliness.

Small Tools

Obviously, the most handy way to store these is in wooden racks. Their position, in the small shop, is not important, but they should, of course, be within easy range of the bench, so that they may be accessible when required and, what is to my mind more important, easily returned to their places as soon as they are done with. The immediate replacement of all tools not immediately wanted, obviates the difficulty, or perhaps I should say the habit, of working under a pile of tools, as referred to in my opening remarks.

In addition to racks for the storage of small tools, I find it very handy to keep on the bench, out of the way, a small wooden box with lid, in which such things as steel rules, centre punches, dividers, small screw-drivers, squares and the like, can be kept. I recommend this procedure, as it enables one immediately to put one's hand on the sort of tool which is constantly in demand. And again, if adopted, this method leaves no excuse for not clearing the bench.

As to the choice of small tools: these things "happen along" as and when they seem necessary. I hesitate to make any specific recommendations; most people are capable of discriminating for themselves what tools are necessary and what are not. But the general run of small tools will fall under the heading of hammers, pliers, spanners, screwdrivers and the like; and the variety of any one type will depend upon the scope of work which it is intended to tackle.

Files

A wealth of matter might be written on the choice, care and storage of files. From time to time, information on the subject from the pens of those well qualified to speak has appeared in THE MODEL ENGINEER. Generally, I find that files do not get the attention which they deserve (and this is particularly evident in the majority of professional engineering shops). Few people keep one set of files for brass and one for steel, to say nothing of a special set for light alloys. Yet some attempt should be made to put aside at least two or three files for brass only. It should be borne in mind that when a file is "worn out" so far as brass is concerned, it is practically "as good as new" for dealing with steel.

Files must be stored separately; they must never be jumbled together in a box, since two files coming into contact with one another will rapidly destroy their cutting surfaces. Spare files should be stored wrapped separately in boxes; but care must be taken that the wrappings cannot attract damp, for rust on a file takes away its keen cutting properties.

The usual method of storing files vertically in racks is to be recommended, as this satisfies the requirement of keeping the files separated and enables them to be selected easily when necessary.

Before use, a file should be well wire-brushed. Probably the best method of ensuring that files are really "at the ready" is to wire-brush them before putting them away.

Fine Tools

If the scope of the amateur shop is to cover the highest classes of engineering, really sound equipment for making fine measurements is essential. To cope with the average dimensions which crop up in the amateur shop the following necessary kit is adequate: 0-1-in. micrometer; 1-2-in. micrometer; 2-3-in. micrometer; 12-in. vernier slide gauge; micrometer depth gauge or vernier depth gauge, 0-6-in. In addition, the following will be required for checking, marking-off and setting-up work: Precision square, protractor, calipers of various types, V-blocks, scribing block, parallel strips, feeler gauge, thread gauge, radius gauge, steel rules. In particular, for marking-off purposes a good surface plate must be obtained (or a sheet of heavy plate-glass, which is quite as good).

(*To be continued*).

A 5-ft. Model Speed Boat

(*Continued from page* 30)

remedied by caulking, and it is now steam-tight everywhere.

The feed-pump is also brass and has a bore ¼ in. dia. by ½ in. stroke, and pumps very well, but I hope to improve on it when I couple it to the crankshaft.

The paraffin blowlamp differs a little from the design and I get a 9-in. to 10-in. flame; the pressure is raised by a cycle pump. The tank holds approximately 1 quart. The nipple is the same as used on "Primus" lamps, which I screwed 3 B.A., as I had difficulty in obtaining taps to suit original thread.

The propeller is made of brass, 3⅜ in. dia., 9-in. pitch, two-bladed, 18 gauge. The blades are cut and fitted in grooves in the boss, which is ⅝ in. dia. and 1 5/16 in. long, and a good fillet of solder to hold them.

The boat is 5 ft. long, 9 in. beam and is built of tin, according to the drawing, but my supply of tin did not enable me to cut all the ten sections in one piece, as will be seen from the photograph.

The whole plant is just fitted up to run temporarily, and I have had it running several times, and giving satisfaction.

The boiler blows off at 100 lb. per sq. in., but the pressure gauge is out of proportion.

The turning was done on a friend's lathe and the whole job has taken me about three years.—L. W. GARDINER.

*Small Capstan Lathe Tools

Notes on "tooling up" for repetition work, with special application to the "M.E." small capstan attachment

By "NED"

MANY of the components produced on small capstan lathes have to be knurled on some part of the diameter, and this operation is one which is often found by no means so simple as it looks. Out of a mixed batch of commercially produced components recently examined, several specimens had the knurling very badly executed, the most common fault being "double-pitching" of the knurl, producing in effect a knurled pattern twice as fine as that of the knurling wheel which produced it. But in some cases the alleged "knurling" was little more than a mere roughening of the surface, which may possibly have served the purpose for which it was intended—more or less—but was certainly not so effective in this respect as a properly knurled surface, to say nothing of its slovenly appearance.

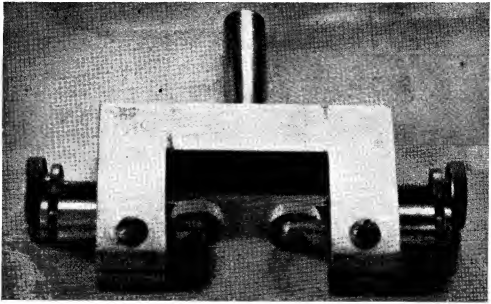
Incidentally, no information exists as to the equipment with which the samples mentioned were produced, and it is not easy to state definitely the causes of the faults noted. They may have been due to inefficient tools, bad setting, or careless operating—or possibly, a combination of all three.

* *Continued from page* 606, *Vol.* 86, "*M.E.*," *June* 25, 1942.

Knurling Processes

As most readers are undoubtedly aware, knurling is not a cutting process, but is effected by impressing or indenting the surface of the work, by rolling contact with a serrated and hardened wheel, which is mounted so as to be capable of revolving freely in its holder (Fig. 29). A fairly considerable pressure is necessary between the knurl and the work, in order to ensure the full depth of indentation, depending upon the coarseness of the knurl and the nature of the material worked upon.

In cases where a single knurling wheel is used, this pressure, no matter from what direction it is applied, represents a heavy side thrust on the work, which may cause it to be thrown out of truth in the chuck, or if fragile, to be bent or even broken off. Consequently, it is the usual practice in production lathes to use two wheels (diametrically opposed for preference) for practically all kinds of knurling, in order to balance and neutralise the side thrust. The two wheels must obviously be mounted so as to be capable of simultaneous radial adjustment (see photo.), to suit the diameter of the work, and this adjustment may be arranged so as to be operable during the course of the



A capstan-head diametrically-opposed knurling tool made by Mr. A. T. Steels, for use with the "M.E." capstan attachment.

knurling operation, enabling the impression to be progressively deepened, or pre-set to the size required for dealing with a batch of identical components.

The latter course is the more commonly adopted in production practice, for fairly obvious reasons, but as will be seen later, it is possible to apply a pre-set knurling tool in such a way as to obtain a progressive *depth* feed—though it is a matter of dispute whether it is any advantage, or even desirable, to do so.

Knurling may be applied to produce a wide variety of patterns on the circumference of turned work, but the most common forms are "straight" (i.e. axial), diagonal (spiral), and "diamond" (crossed), knurling. Any of these may be produced by means of a single knurling wheel, if the latter is designed for its individual purpose; but in the case of diamond knurling, this method is inefficient, and will only operate over a length of work not exceeding the face width of the wheel. In other words, the knurling tool cannot be traversed endwise along the work.

By using two knurling wheels at once, however, diamond knurling can be carried out over any reasonable length of work by traversing the tool-holder endwise. Furthermore, if the wheels are mounted so that their pivot axis can be adjusted at any angle to that of the work, it is possible to carry out either straight, diagonal, or diamond knurling with one pair of straight knurling wheels.

Causes of Faulty Knurling

By far the most common fault encountered in knurling is due to the failure of the knurling wheel to "follow in its own footsteps" as it were, the result being that the impression produced on one revolution is confused or partially obliterated on the next. It is not difficult to understand how this happens, but some readers may be sadly perplexed as to how to avoid it!

When the knurling wheel first comes into contact with the work, and makes its initial impression, it is driven round by the engagement of its teeth with the niches which they produce—though its action cannot be regarded as quite so positive as that of a spur gear engaging with another gear having properly formed teeth. Undoubtedly, a certain amount of slip takes place, depending upon the friction of the knurling wheel running pivot and also the depth of the first impressions produced. But whether this is so or not, it is possible that in a complete revolution of the work, the impressions produced by the wheel do not divide out exactly, and it may finish up with half a tooth space to spare. If this happens, the wheel will produce a second set of impressions when the work goes round again, the result being "double pitching" of the knurl—or in some cases, triple or quadruple pitching may occur. The worst form of this fault is encountered when the metal displaced by the wheel is pushed into the serrations formed on preceding revolutions, so that it breaks away and the resultant surface eventually presents a "chewed" appearance, sometimes made all the worse by the presence of patches of more or less clean knurling.

A Complicated Problem

If, however, the diameter, and thus the circumferential length, of the work could be adjusted to correspond exactly with the pitch length of a certain number of teeth in the wheel, and if slip between the two on the first revolution could be completely eliminated, this fault would not occur. But in practice, it is difficult to ensure this, and the problem is complicated by the fact that the circumferential length on the original outside surface of the work is obviously greater than that on the rolling pitch line when the wheel has penetrated to part or full depth. Undoubtedly, the diameter of the work at the beginning of the operation does influence matters, and there are many cases where a slight adjustment of diameter makes all the difference between success and failure; but an even more important factor in ensuring a certain start is to make the first impression sufficiently deep to give the wheel at least some encouragement to follow its own tracks.

This, it is believed, is where many operators go wrong. The "cautious approach," which is definitely to be commended in many, if not most, machine tool operations, is far more likely to cause trouble when applied to knurling. Instead of feeding the tool into the work gradually, and increasing the pressure according to the "feel," it is best to start deliberately, and with practically full contact pressure. This does not mean slamming the tool in by sheer brute force; the exercise of caution is just as much desirable, but in other ways. It will be obvious, for instance, that if the knurling wheel is brought into contact with the work when the latter is revolving at full speed, the inertia and friction of the wheel will cause it to lag, causing slip and scraping. If it is not practicable to reduce speed for knurling, it should at any rate be *started* at a low speed by stopping the lathe, feeding the knurling tool up, and pulling the belt round for the first two or three revolutions.

It is obvious that if a fairly deep impression can be formed in the work right away, the liability of the wheel to form a second track

on the next revolution is much reduced ; any slight inequality is generally averaged out as the work progresses, and once a good, full-pitched impression is formed, it can usually be maintained to the full depth. If the knurling tool is to be traversed endwise, it is advisable to make certain that it is properly pitched before applying end feed ; very often it is advisable to start off by engaging about half the width of the wheel on the extreme end of the work, when the nature of the latter permits. To many readers, these instructions may seem to indicate that knurling is a haphazard, hit-and-miss sort of process, but if one considers the regularity with which excellent work can be, and is, produced in production practice on all sorts of machines, it is evident that like all other machine tool processes, it depends only upon reasonable care and skill, in conjunction with the correct methods.

Copious lubrication is essential for efficient knurling, not only to reduce the friction of the wheel with the work, and to carry away the considerable heat which is inevitably generated, but also to ease the burden of the very heavily loaded knurling wheel pivots. Wear of these pivots is a prolific cause of erratic action of the wheels, and every care should be taken to keep the latter working as freely and smoothly as possible. The effect of chips or swarf becoming jammed between wheel and holder is obviously anything but good, and a careful watch should be kept to avoid or correct it.

The most suitable lubricant for knurling is a fairly heavy body tapping oil, but where soluble oil is used for the cutting operations, it will serve in this case also, so long as it is not too thinly diluted. Sometimes the use of oil in knurling is objected to because it leaves the work looking rather dirty, but subsequent cleaning of machine parts is not a big job, and is usually a matter of regular routine in production shops.

Effect of Materials

The metals which are the most ductile are generally the easiest to knurl. Copper—which in other respects is often regarded as the bane of the turner's existence—takes an excellent impression, though it is not used a great deal in production, except in certain electrical components.

Most aluminium alloys knurl very nicely, and much the same applies to bronzes and naval brass, but some of the extruded brasses and screw rods, which are very considerably used in production, are liable to produce some queer little snags in knurling, due to their brittle nature and the splintery chips which are liable to become imbedded in the wheel and mar the work. Mild and alloy steels knurl quite well, but call for very heavy contact pressure, depending on their hardness and toughness. Cast-iron is liable to be difficult, but fortunately knurling of this material is not at all common.

Plastic materials, such as vulcanised fibre, ebonite, and the various phenol compositions (bakelite) are liable to be troublesome ; the most important precaution to observe when knurling them is to conduct heat away very promptly, to avoid any local rise of temperature. Thin soluble oil, or even plain water, is advisable for this purpose. The knurling operation should not be unduly prolonged, or the surface of the material may become spongy from the "kneading" action of the tool, and possibly break away

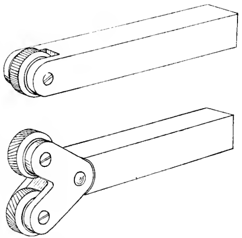


Fig. 29. Standard type of single- and double-wheel knurling tools for cross slide application.

in patches. It is often impossible to make a really deep knurl on these materials for this reason.

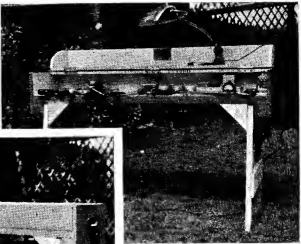
Effect of Knurling on Work Diameter

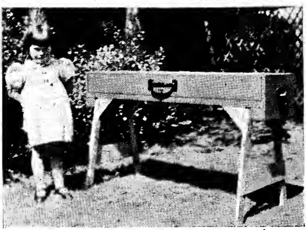
As knurling is not a cutting process (a certain amount of material is usually removed, but this is only incidental, and is to be regarded as a sign of inefficiency in the action of the knurl rather than otherwise) it follows that the metal displaced to produce the serrations in the work is thrown up so as to increase the diameter of the ridges. The exact amount by which the overall diameter is increased is not easy to determine beforehand, and will vary in the event of the knurling action being erratic. If it should happen that the knurled work must pass an upper limit test, it will be necessary to reduce the diameter before knurling to an extent which can only be determined by experiment.

(To be continued)

A PORTABLE WORK BENCH

By D. S. CLIBBORN





The portable work bench, shown open and closed.

BECAUSE I am engaged on war work it has been necessary for me to change my residence three times since the outbreak of hostilities. The question had therefore to be faced squarely, as to what would be the possibility of continuing model work of any description, and it seemed to me, after making the first change, that the best plan of action would be to obtain a small portable bench of special design.

After due consideration the bench illustrated was evolved, the main points in its favour being as follows :—

First and foremost, it had to be a neat and tidy affair when closed ready for transport, and I flatter myself that this result has been obtained, as reference to the photographs will show. This point will be better appreciated if the reader will imagine the legs removed, dismantled and placed inside the main top portion, when the whole affair resembles a tool-chest.

The second point (just mentioned) is that the supporting legs can be dismantled by the use of a screwdriver only, and after binding with twine fit very snugly into the main top.

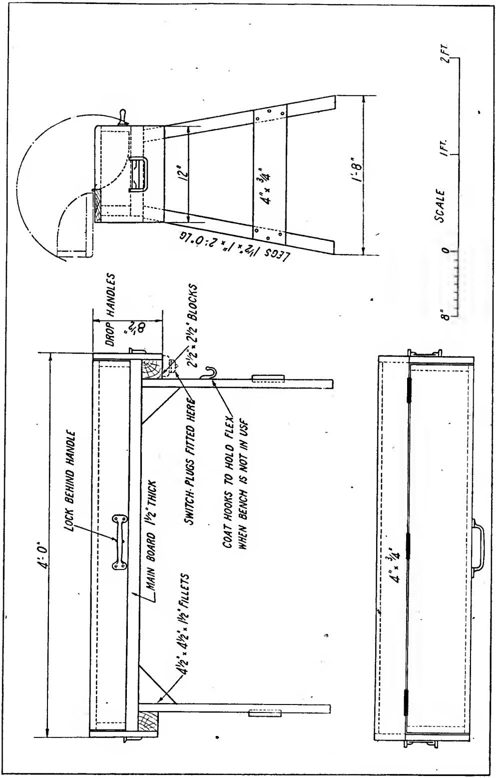
The third point for consideration was that it should be robust enough to allow me to tackle all normal light hand work, including hammering, and therefore the main board is $1\frac{1}{2}$ in. thick.

Fourthly, the cover must hinge back to provide shelf room without any fear of straining the hinges, and it will be seen that by allowing a comparatively large " overlap " on the top of the back cover this object has been achieved.

Fifth and last point, arrangements had to be available for coupling up to a 230/250-volt household supply, and this has been attained by screwing a wooden switch-plate on the underside of one end complete with two 5-amp. switch-plugs and a length of good quality lighting flex with a 5-amp. adaptor at the end for plugging into the household supply.

To carry the closed " tool chest," which is painted olive-green, a black-enamelled drop handle is fixed at each end and, in addition, a large fixed black-enamelled handle is screwed on the front of the cover. By the use of a strong lock, also in the front of the cover and behind this handle, the cover is held securely enough in position to allow the whole chest to be lifted by the one fixed handle if need be—an advantage if only one person is available to carry it.

The equipment includes a Record Junior Imp vice, a Rawlplug electric soldering-iron, and electric drill (Gilbert Junior), a box containing drills and bits of various sizes, files, etc., a small jeweller's saw, a small Record plane, small hammer, wood-chisels, pliers, etc., etc. A portable table lamp has also been obtained, but this has to be transported among personal luggage.


LEGS 1½" x 1" 2:0 LG
12"
4" x ¾"
1'-8"
SCALE
8"
0
1FT.
2FT.
DROP HANDLES
8½"
2½" x 2½" BLOCKS
SWITCH-PLUGS FITTED HERE
COAT HOOKS TO HOLD FLEX WHEN BENCH IS NOT IN USE
LOCK BEHIND HANDLE
MAIN BOARD 1½" THICK
4½" x 4½" x 1½" FILLETS
4'-0"
4" x ¾"

Letters

Lead and Pre-admission

DEAR SIR,—We gather from your correspondent that the piston gets a "terrific clout" at the commencement of the stroke, and then it runs away from the steam. I am sure, if he thinks for a moment, he will realise that he could not get a piston speed which would be quicker than the expansion of the steam. I advise that he read the article in Vol. 70, No. 1714, page 250, the last paragraph of which explains the action. With a sensible cut-off, there will always be *some* pressure on the piston.

Take Boyle's Law (although not exactly correct for steam, it is near enough) with regard to an initial pressure of, say, 65 lb. above atmosphere, and cut-off at one-fourth, we should still have 5 lb. above atmosphere at the end of the stroke, neglecting change of temperature and condensation. We do not get more power by cutting off; in fact, we get less. When a loco. is starting under load, it has to run in full steam; when the inertia has been overcome, the driver notches up; that is, puts the cut-off into operation, because less power is required. We certainly get economy. For example, if the cut-off could be at one-fourth, the boiler would have, roughly, only one-fourth the quantity of water to evaporate. But it is stated that by using the cut-off, more power is obtained. At the faster speeds that very often is the case, owing to the reduction of back pressure. In full steam, at the above pressure, the exhaust would open at, say, 50 lb. pressure; but working in cut-off, it would open at, say, 5 lb. If indicator diagrams could be taken on these small engines, it would be seen that the back pressure in the first case was considerable, and in the second case it would be near the atmospheric line. The increase of power, when working in cut-off, is, therefore, brought about entirely by the reduction of back pressure.

Yours faithfully,

Barnsley. J. W. SHAW.

Clubs

The Society of Model and Experimental Engineers

There will be a meeting of the Society at The Caxton Hall, Westminster, to-morrow, 10th July, at 7 p.m., when a series of Lecturettes by members will be given. Mr. F. C. Yalden will deal with "Some Examples of Engineering Production," and Mr. Lister will describe a Precision Rotary Stud Switch which has been put into production by Messrs. Muirhead's. Any readers who care to attend will be welcome.

Secretary, H. V. STEELE, 14, Ross Road, London, S.E.25.

Glasgow Society of Model Engineers

The combined meeting held on 13th June was a complete success, over fifty members, friends, and visitors being present, thirty-three of whom went out to a previously arranged tea. Visitors were present from Ayr, Edinburgh, Gloucester, Wallasey, and West Hartlepool M.E. societies.

Among the exhibits were six locos. and seven boats, ranging from a R.A.F. rescue boat to a detailed destroyer, complete with camouflage. Among the demonstrations, Mr. R. Todd steamed his new and beautifully finished ½-in. scale N.B.R. loco., using a specially shaped metal cover to protect the paintwork until excess oil and water was out of the cylinders.

Mr. W. Denwick started for the first time his newly finished 30-c.c. two-stroke racing engine. To demonstrate in this manner an engine that has never run shows a confidence which in this case was certainly not misplaced, as the engine started on the third pull. Mr. K. Rose demonstrated his opposed-piston flash steam engine which by tachometer was running at 11,000 r.p.m. amidst a cloud of smoke and steam.

Hon. Sec., Mr. J. SMITH, 785, Dumbarton Road, Glasgow.

The Kent Model Engineering Society

The meeting to be held on July 14th at Sportsbank Hall, Catford, S.E.6, at 7.30, will take the form of a Rummage Sale; each member is asked to make a special effort to bring along for sale some item such as material, model or tool.

The Society's war effort track runs are:—

July 25th, Kolster Brande's Fête, at Sidcup, 2 p.m.

August 3rd (Bank Holiday), Lewisham's effort to provide a Mobile Ambulance for Russia. All day Fair, Grove Park.

August 29th, Morden's K.R.N.S. Red Cross Fête, at Morden, Surrey, 2 p.m.

Hon. Sec., W. R. COOK, 103, Engleheart Road, Catford, London, S.E.6.

NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., Cordwallis Works, Cordwallis Road, Maidenhead, Berks.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," Cordwallis Works, Cordwallis Road, Maidenhead. Berks.